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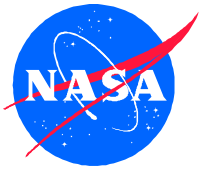
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November 4-5, 1998

HWCI 4.0

Phases of Operation

- Integration & Test (I&T) Phase
- Mission Readiness Review
- Launch Site (Remote Operation Control Center)
 - Pre-flight Readiness
 - Launch Ready Review
 - Launch
 - Flight Management Until Stabilized Float
- Operation Control Center
 - Flight Management for ~60 + Days
- Termination & Recovery
 - Normally Executed Via Line-Of-Sight By Air
 - Executed Only By Authorization From OCC



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HWCI 4.1.1

Mission Forecast Trajectory

- Requirements Traceability
 - DTRD Section 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.1.5
- Functional and Performance Requirements
 - 4.1.1.a: Forecast flight trajectories over region and period which is of scientific interest
 - 4.1.1.b: Establish nominal turnaround period for latitudes of interest
 - 4.1.1.c: Establish period for flight operation consistent with safety, overflight, & science requirements and which can be served by a suitable launch site
- HWCI Description
 - “NSBF Winter Stratospheric Wind Study” demonstrates higher variability of stratospheric wind speed and direction during the winter primarily due to stratwarming
 - DAO/UKMO satellite data demonstrates a relatively higher degree of persistence along lines of latitude for summer stratospheric winds between turnaround



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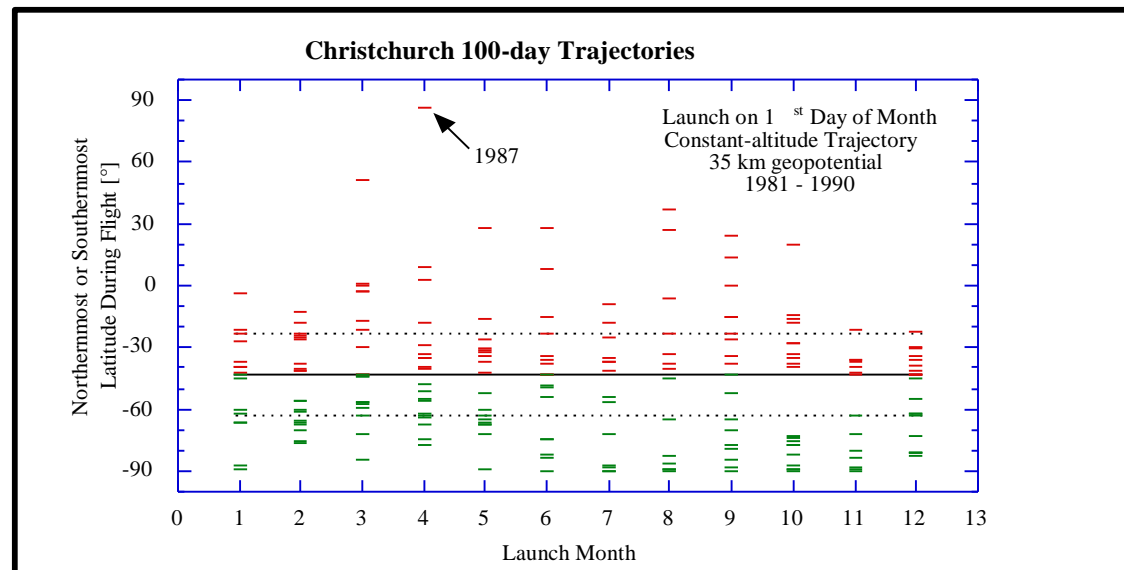
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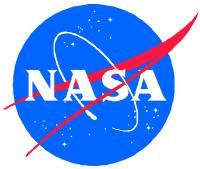
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HWC1 4.1.1

Mission Forecast Trajectory

- Tiger science requirements best supported with New Zealand launch location
 - 54 days @ 115 Kft. (35 km)
 - 78 days @ 105 Kft. (32 km)
- GAC data analysis indicates large percentage of data falls within +/- 20 degree latitude bounds during December - February period for 43de. Lat.



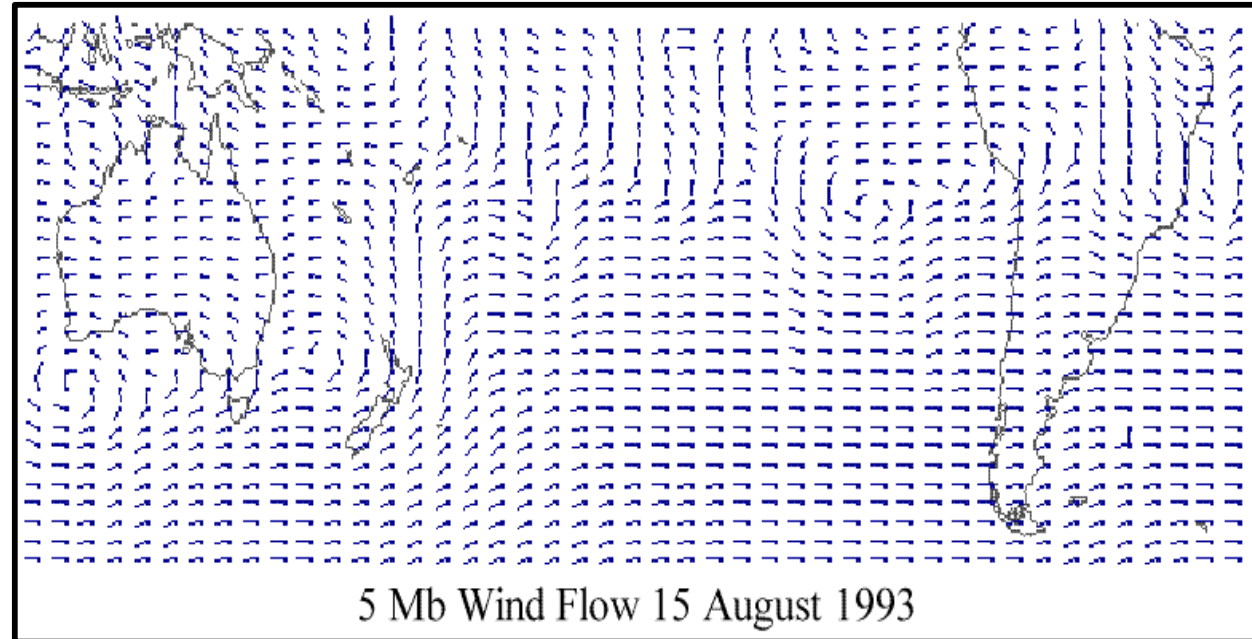


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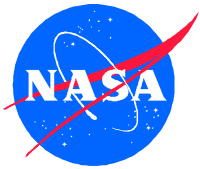
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Mission Forecast Trajectory



- 5 mb plot from NSBF Winter Wind Study shows variability caused by stratwarms



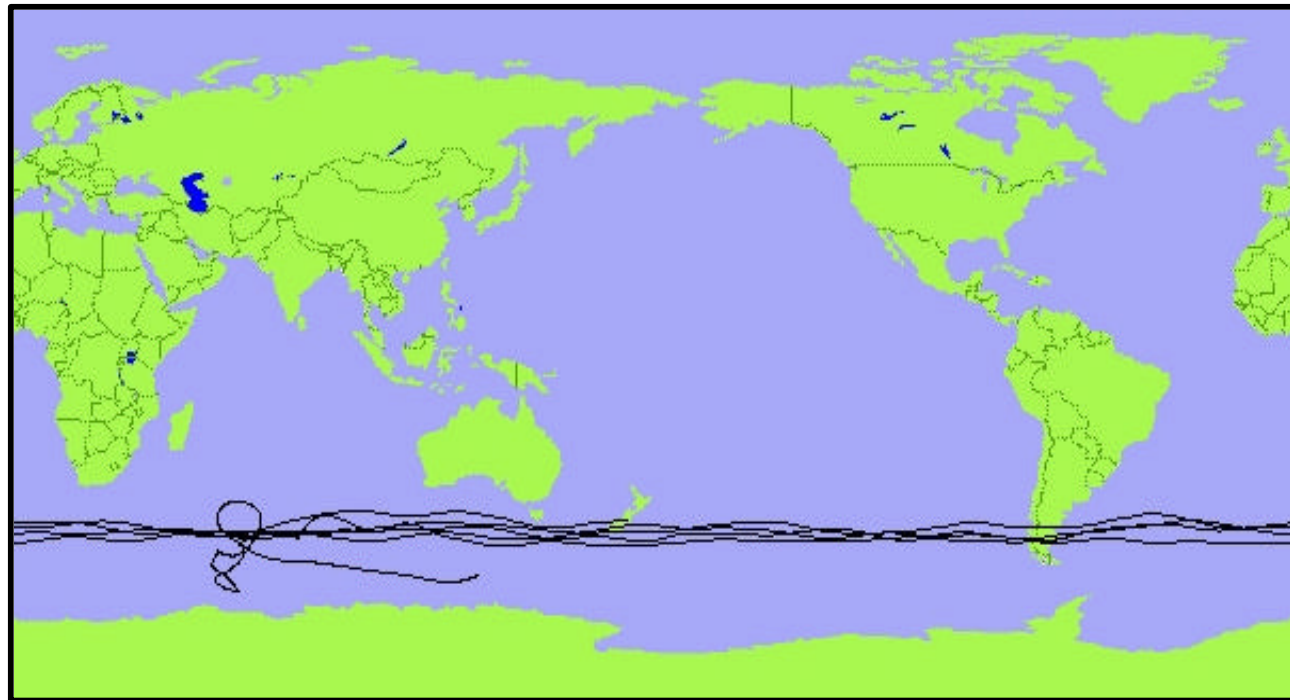
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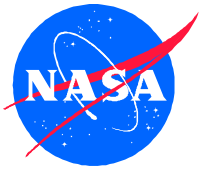
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Mission Forecast Trajectory



- GAC trajectory simulation for 6 mb (35 km) height
 - Turnaround shown over South Indian Ocean



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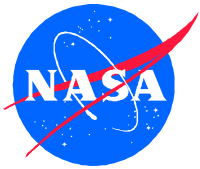
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Mission Forecast Trajectory

- Risk Assessment & Mitigation/Reliability
 - Perform analysis of precision of DAO/UKMO forecast data as compared with previous NASA balloon trajectories, determine standard deviation of error (underway)
 - Launch “Pathfinder” sounding balloons to verify circulation patterns over entire summer season
 - Monitor transition of stratospheric turnaround conditions as they propagate from polar regions
 - GAC analysis suggests higher probability of trajectory drifting toward the South Pole rather than north for period of December through February (Christchurch 1981-1990 @ 35 km height)
 - Fly only in summer season between turnarounds
 - Use Real time trajectory analysis/forecasting for monitoring stratospheric winds



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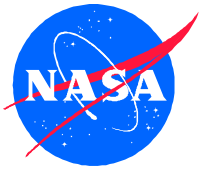
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HWC1 4.1.2

Real-Time Trajectory Planning

- Requirements Traceability
 - DTRD Section 4.1.1
- Functional and Performance Requirements
 - 4.1.2.a Perform real-time balloon trajectory analysis
 - 4.1.2.b Automate trajectory analyses to the highest extent possible
 - 4.1.2.c Evaluate structure of current global stratospheric circulation patterns
 - 4.1.2.d Provide trajectory analyses as needed by mission operations personnel
 - 4.1.2.e Provide trajectory analyses on a daily basis
 - 4.1.2.f Indicate upcoming undesirable trajectory characteristics
 - 4.1.2.g Provide real-time descent trajectory estimates from current environment data
 - 4.1.2.h Automatically display ballooncraft position
 - 4.1.2.i Trajectory prediction accuracy shall be better than or comparable to extrapolation from last hour of flight (Balloon Flight Persistence)



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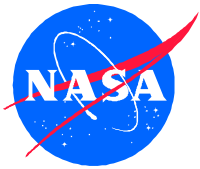
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HWC1 4.1.2

Real-Time Trajectory Planning

- HWC1 Description
 - Trajectory Simulation Mission Operations WorkStation (MOWS)
 - Provides up to 10 simultaneous trajectory simulations
 - Real time predictions
 - Based on daily stratospheric forecasts
 - 5-day look-ahead trajectories
 - User-configurable for “what if” analyses
 - Provides evaluation of propagation of turnaround conditions from poles
 - Displays prediction accuracy information
 - Computer-generated display of actual and forecasted trajectories
 - Two forecast data sources (GSFC Data Assimilation Office, United Kingdom Meteorological Office)
 - Forecast data obtained automatically over the internet
 - Mission operations personnel interpret and act on MOWS analyses



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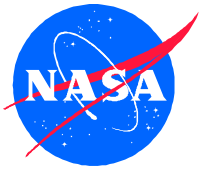
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HWC1 4.1.2

Real-Time Trajectory Planning

- Risk Assessment & Mitigation/Reliability
 - Benefits of MOWS
 - Reduce risks associated with overflight, termination, and safety by providing mission operations personnel with real-time “what if” data from multiple trajectory predictions
 - Anticipate forecasted changes to typical circulation patterns (summer)
 - Stratospheric forecast data
 - Increases trajectory prediction accuracy during periods of increased temporal variability
 - Provides insight on propagation of turnaround conditions
 - Trajectory prediction uncertainty information displayed with predictions
 - Automate trajectory prediction process
 - Eliminate human error associated with fatigue and repetition during 100-day flights
 - Risks of MOWS
 - New software
 - Reliance on internet connections and coordinated data transfers from data providers to MOWS
 - Trajectory prediction accuracy a function of forecast accuracy
 - Risk mitigation steps
 - MOWS development plan includes two multi-month end-to-end tests of the software prior to system delivery and one end-to-end test after system delivery, prior to flights
 - MOWS development plan includes thorough testing of internet connections prior to system delivery
 - Utilizing 2 independent atmospheric data sources



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HWC1 4.1.3

Mission Planning-Safety

- Requirements Traceability
 - DTRD Section 4.1.2
- Functional and Performance Requirements
 - 4.1.3.a: Operate in accordance with balloon program ground safety plan
 - 4.1.3.b: Operate in accordance with balloon program payload safety plan
 - 4.1.3.c: Conduct flight operation in accordance with NASA Balloon Program Safety Analysis Report
 - 4.1.3.d: Conduct flight operations in accordance with applicable FAA Part 101 and ICAO regulations
 - 4.1.3.e: Conduct operations in accordance with NASA-PSL Operating Procedures
 - 4.1.3.f: Evaluate established procedures with respect to ULDB configuration and flight requirements



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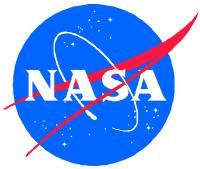
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HWC1 4.1.3

Mission Planning-Safety

- HWC1 Description
 - NASA Balloon Program NSBF Ground Safety Plan; dated June 1998
 - NASA-STD-8719.8 “Expendable Launch Vehicle Payload Safety Review Process Standard; dated June 1998
 - Safety Analysis Report for Balloon Programs Conducted by the National Scientific Balloon Facility Palestine, Texas; dated January 1985
 - Safety Review for Balloon Programs Conducted by the National Scientific Balloon Facility Palestine, Texas; dated September 1988
 - FAA Regulations Part 101 “Moored Balloons, Kites, Unmanned Rockets, and Unmanned Balloons”
 - International Civil Aviation Organization (ICAO) Regulations, Appendix 4 to Annex 2, “Rules of the Air”
 - NASA-PSL Operating Procedures; dated 8/19/98



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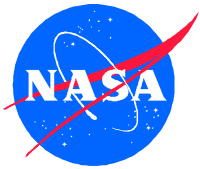
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HWCI 4.1.3

Mission Planning-Safety

- Risk Assessment & Mitigation/Reliability
 - Mitigate risk by flying during seasonal periods which have highest probability for predictable stratospheric wind speed and direction
 - Restrict flight operation to not occur during stratospheric wind turnaround
 - The first ULDB flight will be in the southern hemisphere
 - Fewer countries for overflight
 - Available land masses have lower population densities
 - Incorporate NASA ULDB Safety Review requirements
 - Continuous global data and command allow termination anytime



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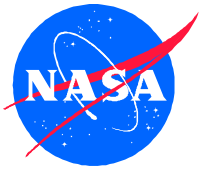
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HWCI 4.1.4

Mission Planning-Launch Site

- Requirements Traceability
 - DTRD Section 4.1.3
- Functional and Performance Requirements
 - 4.1.4.a: Select launch site consistent with trajectory forecast
 - 4.1.4.b: Launch site approved by host country / agency
 - 4.1.4.c: Launch site satisfies safety requirements
 - 4.1.4.d: Launch site satisfies ICAO requirements
 - 4.1.4.e: Launch site provides facilities and launch area
 - 4.1.4.f: Sufficient launch window to accommodate operation
- HWCI Description
 - Code I establish required agreements
 - Established precedent for launches from Christchurch, NZ; Dunedin, NZ, and Alice Springs, AU
 - Climatology supports operations from each location
 - Candidate site at Wigham Field located south of Christchurch (in process of review)



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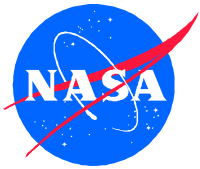
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HWC1 4.1.4

Mission Planning-Launch Site

- Acceptable launch facilities exist at Alice Springs
- Risk Assessment & Mitigation/Reliability
 - No agreement is established with New Zealand
 - Risk considered low at this time
 - Anticipate no problems with either New Zealand or Alice Springs launch latitudes as it affects getting international approval for overflight
 - Wingham Field should alleviate conflict with commercial operations at Christchurch Airport



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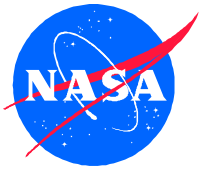
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HWCI 4.1.5

Mission Planning-International

Agreements

- Requirements Traceability
 - DTRD Section 4.1.4
- Functional and Performance Requirements
 - 4.1.5.a: Agreement / MOU for launch site
 - 4.1.5.b: Notice of intent sent to international community
 - 4.1.5.c: Resolve issues concerning technology transfer
 - 4.1.5.d: Agreement / MOU for planned termination/recovery site
- HWCI Description
 - Meetings with Code I & NASA Export Office:
 - Preliminary indication that technology transfer may not be an issue
 - Draft “Flight Operation and Systems Description Plan” will go to Code I by 12/1/98
 - Demo 2000 “Flight Operation and Systems Description Plan” will be submitted by December 1999



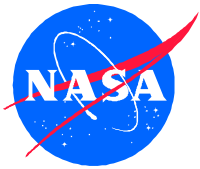
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HWCI 4.1.5 Mission Planning-International Agreements

- Existing MOU with University of New South Wales for Alice Springs
- Risk Assessment & Mitigation/Reliability
 - MOU for New Zealand Demo 2000 launch site not established
 - Precedent established / considered low risk
 - Precedent with international overflight of scientific balloons from New Zealand and Alice Springs...anticipate no conflicting issues
 - MOU for candidate country for termination / recovery not established



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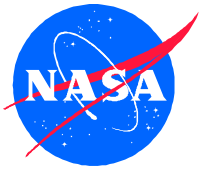
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HWCI 4.1.6

Mission Planning-Interagency Agreements

- Requirements Traceability
 - DTRD Section 4.1.5
- Functional and Performance Requirements
 - 4.1.6.a: Establish agreements required for launch, flight, and/or recovery support
 - 4.1.6.b: Insure RF frequency clearances obtained
 - 4.1.7.b: Insure hazardous materials handling licenses / agreements are in place
- HWCI Description
 - May require review of MOU with NSF as contingency for recovery assistance
 - At this time no hazardous licenses will be required
 - NSBF is experienced in getting foreign frequency authorizations as may be required



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HWCI 4.1.6

Mission Planning-Interagency Agreements

- Risk Assessment & Mitigation/Reliability
 - Anticipate no issues
 - Early submittal to Code I will help identify issues early on



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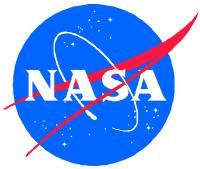
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HWCI 4.1.7

Mission Planning-Operations Plan

- Requirements Traceability
 - DTRD Section 4.1, 4.2, 4.3, 4.4, 4.5
- Functional and Performance Requirements
 - 4.1.7.a: Complete Operations Plan prior to Mission Readiness Review
- HWCI Description
 - Note “Requirements & Functional Specification Verification Matrix” section 4.1.7



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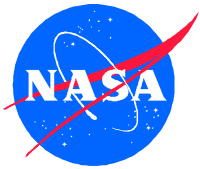
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HWCI 4.2.1

Integration & Test Facilities

- Requirements Traceability
 - DTRD Section 4.2.1
- Functional and Performance Requirements
 - 4.2.1.a: Ballooncraft fabrication area (400 sq. ft.)
 - 4.2.1.b: Science instrument preparation area (400 sq. ft.)
 - 4.2.1.c: Support systems preparation area (800 sq. ft.)
 - 4.2.1.d: Telephone & Internet communications
 - 4.2.1.e: Provide machine shop work area (780 sq. ft.)
 - 4.2.1.f: Provide antenna platform (100 sq. ft.)
 - 4.2.1.g: Provide electrical / lighting / heating / cooling
 - 4.2.1.h: 2.5 ton monorail traverse hoist (motor driven)
 - 4.2.1.i: Bay doors 15 ft. (w) X ~14 ft. (h)
 - 4.2.1.j: Provide storage area
 - 4.2.1.k: Backup power



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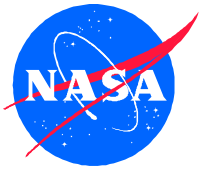
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HWC1 4.2.1

Integration & Test Facilities

- HWC1 Description
 - Utilize Bldg D2 at NASA WFF
 - Machine shop area 780 sq. ft. (install partition)
 - Storage area: 200 sq. ft. secured / 500 sq. ft. open
 - Install Power: 120 VAC/20amp quad every 6 ft. / 208-220 3-phase for machine shop
 - Install HVAC / Restrooms / Antenna Platform
 - Install 5 ea. telephone / Internet RJ-45 every 6 ft.
- Risk Assessment & Mitigation/Reliability
 - Supports one ballooncraft at a time
 - Requires some renovation
 - Requires fabrication of antenna platform
 - Can be available 1 April '99 (On Schedule)



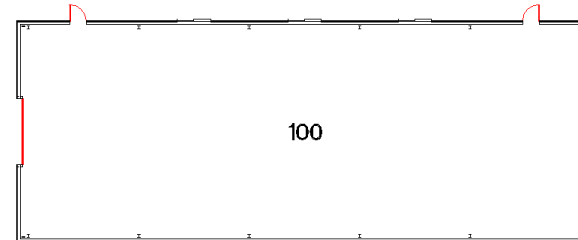
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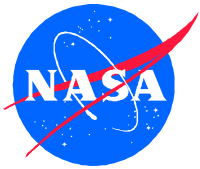
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Integration & Test Facilities



FIRST FLOOR PLAN





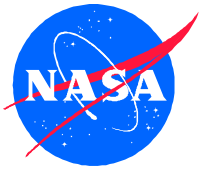
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HWCI 4.2.2 Launch Site Facilities

- Requirements Traceability
 - DTRD Section 4.3.1
- Functional and Performance Requirements
 - 4.2.2.a: Ballooncraft flight preparation area (400 sq. ft.)
 - 4.2.2.b: Science instrument preparation area (400 sq. ft.)
 - 4.2.2.c: Support systems preparation area (800 sq. ft.)
 - 4.2.2.d: Telephone & Internet communications
 - 4.2.2.e: Flight operations / rigging work area (800 sq. ft.)
 - 4.2.2.f: Remote Operation Control Center (ROCC) work area (300 sq.ft.)
 - 4.2.2.g: Antenna platform
 - 4.2.2.h: Provide electrical / heating / cooling
 - 4.2.2.i: Located adjacent to launch area
 - 4.2.2.k: Backup power



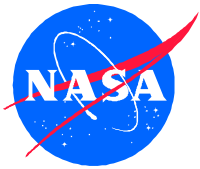
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HWC1 4.2.2 Launch Site Facilities

- HWC1 Description
 - New Zealand
 - Christchurch (Wigham Field) OR Dunedin
 - Australia
 - Alice Springs (Alternative) Existing Launch Facility
- Risk Assessment & Mitigation/Reliability
 - Assessing facility (site) options in New Zealand



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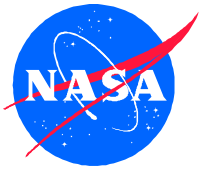
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HWCI 4.2.3

Operation Control Center

- Requirements Traceability
 - DTRD Section 4.4.1
- Functional and Performance Requirements
 - 4.2.3.a: Flight monitor work area (200 sq. ft.)
 - 4.2.3.b: Telephone & Internet communications
 - 4.2.3.c: Antenna platform
 - 4.2.3.d: Provide electrical / lighting / heating / cooling
 - 4.2.3.e: Backup power
- HWCI Description
 - T&E Facility @ NSBF Palestine, Texas
 - Existing facility with backup generator / UPS
 - Communications infrastructure in place
 - Location of flight operations management



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HWC1 4.2.3

Operation Control Center

- Risk Assessment & Mitigation/Reliability
 - Some re-routing / extension of communications cabling in T&E building
 - Utilize existing TDRSS network and open internet infrastructure
 - Commercial telephone provider has no redundancy to long distance backbone; alternative: cellular voice / WSGT for short term TDRSS backup / INMARSAT Terminal at OCC will provide backup





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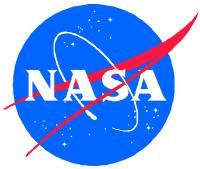
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HWCI 4.3.1

LOS Ground Telemetry Receive Systems

- Requirements Traceability
 - DTRD Section 4.2.2, 4.3.2, 4.5.2
- Functional and Performance Requirements
 - 4.3.1.a: Provide LOS RX for I&T
 - 4.3.1.b: Provide LOS RX antenna for I&T
 - 4.3.1.c: Provide receiver for ROCC
 - 4.3.1.d: Provide Rx Antenna for ROCC
 - 4.3.1.e: Receive TM to edge of balloon line-of-sight @ ROCC
 - 4.3.1.f: Receive up to 100 kbps biphas
 - 4.3.1.g: Provide receiver for seatpack (remote termination)
 - 4.3.1.h: Provide seatpack RX antenna
 - 4.3.1.i: Receive TM out to 50 miles using seatpack
 - 4.3.1.j: Provide analog baseband recording at ROCC



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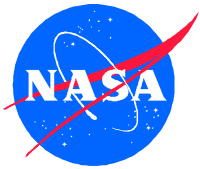
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HWCI 4.3.1

LOS Ground Telemetry Receive Systems

- HWCI Description
 - Existing L-Band telemetry receiver(s)
 - NASA WFF will support I&T phase
 - NSBF will support ROCC and seatpack
 - No requirement for OCC
 - Microdyne 1100-AR's (or equiv.) @ launch site
 - Emheiser ETR-48 D1A for portable seat pack
 - 6' parabolic receive antennas @ launch site
 - Stub receive antenna for local testing / I&T
 - Monopole antenna for aircraft mount / seatpack use
 - Wideband 7 channel recorders at ROCC
- Risk Assessment & Mitigation/Reliability
 - Proven systems as previously demonstrated on conventional and LDB flights.
 - Little OR No Risk



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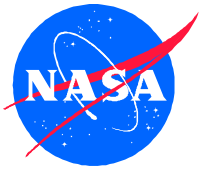
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HWCI 4.3.2

LOS (UHF Command)

System

- Requirements Traceability
 - DTRD Section 4.2.2, 4.3.2, 4.5.2
- Functional and Performance Requirements
 - 4.3.2.a: Provide command transmitter
 - 4.3.2.b: Provide fsk modulation
 - 4.3.2.c: Provide low power (~ 4 W) & high power selectable RF amplification (~ 25 W)
 - 4.3.2.d: Remote “key to transmit”
 - 4.3.2.e: RS232 command signal line interface
 - 4.3.2.f: Battery or 110 VAC powered
 - 4.3.2.a: Provide directional 10 db gain antenna
 - 4.3.2.b: Provide omni directional monopole antenna
 - 4.3.2.c: Command to edge of balloon line of sight range



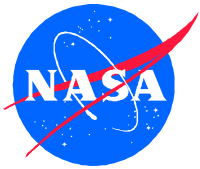
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HWC1 4.3.2 LOS (UHF Command) System

- HWC1 Description
 - PSL UHF Balloon Command System
 - 429.5 Mhz telemetry transmitter
 - 25 watt selectable RF power amplifier
 - FSK Modulation compatible with LOS command Rx
 - RS232 Interface
 - Max Rad MYA4303 10db gain yaggi antenna
 - Max Rad MBS406 monopole antenna
- Risk Assessment & Mitigation/Reliability
 - Proven systems as previously demonstrated on conventional and LDB flights.
 - Demonstrated to command to edge of balloon TM range



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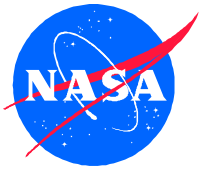
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HWC1 4.3.3

PCM Decommutation

- Requirements Traceability
 - DTRD Section 4.2.2, 4.3.2, 4.5.2
- Functional and Performance Requirements
 - 4.3.3.a: Provide PCM decommutation
 - 4.3.3.b: Provide PCM bit synchronization
 - 4.3.3.c: Support 3ea RS232 data channels via single PCM data channel
 - 4.3.3.d: Support digital & analog channels
 - 4.3.3.e: Provide TLM PCM data display
 - 4.3.3.f: Configurable frame format setup



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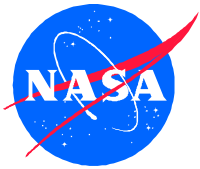
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HWCI 4.3.3

PCM Decommutation

- HWCI Description
 - PSL PC-PCM decommutation
 - Standard bit synch (various)
 - PSL TLM PCM display (ULDB HSK)
- Risk Assessment & Mitigation/Reliability
 - Proven systems as previously demonstrated on LDB flights.



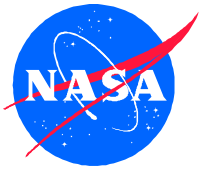
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HWCI 4.3.4 INMARSAT-C

- Requirements Traceability
 - DTRD Section 4.2.2, 4.3.2, 4.4.2, 4.5.2
- Functional and Performance Requirements
 - 4.3.4.a: Provide INMARSAT-C Transmit / Receive terminal for I&T, ROCC, OCC, & Seatpack
 - 4.3.4.b: Provide INMARSAT-C Internet connectivity for I&T and OCC
- HWCI Description
 - Thrane & Thrane TT3022A/C Terminal
 - Thrane & Thrace TT3001B marine antenna
 - Internet (data & command)
- Risk Assessment & Mitigation/Reliability
 - Proven systems as previously demonstrated on LDB flights.



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HWCI 4.3.5

Argos Receive

- Requirements Traceability
 - DTRD Section 4.2.2, 4.3.2, 4.4.2
- Functional and Performance Requirements
 - 4.3.5.a: Receive Argos using uplink receiver
 - 4.3.5.b: Receive Argos via global network over INTERNET at the I&T and OCC
- HWCI Description
 - Use Argos Uplink Receiver w/RS232 interface
 - Use INTERNET addressing for Service Argos automatic data distribution
- Risk Assessment & Mitigation/Reliability
 - Currently used by NSBF LDB
 - Risk - Low



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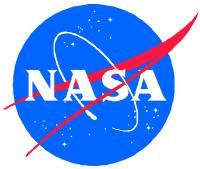
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HWCI 4.3.6

TDRSS Mission Planning Terminal

- Requirements Traceability
 - DTRD Section 4.4.2
- Functional and Performance Requirements
 - 4.3.6.a: Schedule project TDRSS events
 - 4.3.6.b: Support Add / Change requests
 - 4.3.6.c: Confirm event scheduling
 - 4.3.6.d: Submit Type-8 Vector Reports
 - 4.3.6.e: Submit Project GCMR's
 - 4.3.6.f: Display Project UPD's
 - 4.3.6.g: Print Schedules
 - 4.3.6.h: Support "on demand" access
 - 4.3.6.i: Remain current with NCC revisions
 - 4.3.6.j: Desire backward compatibility with LDB



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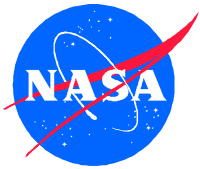
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HWC1 4.3.6

TDRSS Mission Planning Terminal

- HWC1 Description
 - Utilize Scheduling server at GSFC (Code 451)
 - Customized for each project
 - Scheduled via INTERNET
 - IP specific address & authentication access
 - Scheduling terminal is PC Based using Internet Explorer or Navigator
- Risk Assessment & Mitigation/Reliability
 - LDB has been “pilot” project during development
 - LDB Project customized UPD / GCMR configuration and PIN I.D.s
 - NSBF has been using this scheduling service to provide the development team user feedback
 - Low Risk - Scheduled to be fully operational 12/98 (LDB)



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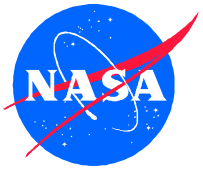
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HWC1 4.3.7

TDRSS Command / Data Interface

- Requirements Traceability
 - DTRD Section 4.4.2
- Functional and Performance Requirements
 - 4.3.7.a: Receive TDRSS ballooncraft return telemetry at the OCC
 - 4.3.7.b: Send TDRSS ballooncraft commands during scheduled forward events
 - 4.3.7.c: Interface ballooncraft return / forward telemetry with ULDB ground station computer



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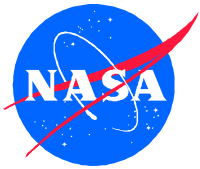
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HWC I 4.3.7

TDRSS Command / Data Interface

- HWC I Description
 - TCP/IP interface with ULDB ground station computers
 - Primary Approach
 - Utilize WDISC TCP/IP interface
 - CCSDS compatible
 - Proof of development scheduled 12/98
 - Backup Approach
 - Utilize PTP at Palestine
 - Converts UDP/IP to TCP/IP or Serial
 - Both approaches via closed IONET (in place)
- Risk Assessment & Mitigation/Reliability
 - WDISC currently under development
 - PTP is established but requires extra equipment on site

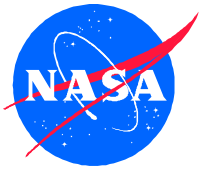


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HWCI 4.3.8 GPS Clock

- Requirements Traceability
 - DTRD Section 4.2.2, 4.3.2 4.4.2
- Functional and Performance Requirements
 - 4.3.8.a: Provide absolute time reference
 - 4.3.8.b: Accurate within 0.1 second or better
 - 4.3.8.c: Used for setting ground computer clocks
 - 4.3.8.d: IRIG B (analog record)
 - 4.3.8.e: RS232 interface
 - 4.3.8.f: Numeric display of time
- HWCI Description
 - Various GPS clocks used throughout available
- Risk Assessment & Mitigation/Reliability
 - Low



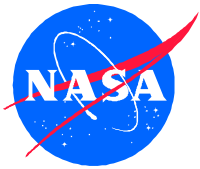
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HWC1 4.3.9 OCC Local Area Network

- Requirements Traceability
 - DTRD Section 4.4.2
- Functional and Performance Requirements
 - 4.3.9.a: Provide T1 open IONET (Offsite Data/Cmd)
 - 4.3.9.b: Provide T1 closed IONET (TDRSS)
 - 4.3.9.c: Direct ULDB External Interface Server to NSBF Firewall link
 - 4.3.9.d: Physically secured ULDB LAN
 - 4.3.9.e: NSBF Network Security Plan reflect ULDB requirements
- HWC1 Description
 - Existing T1 open IONET and T1 closed IONET
 - NSBF installing Raptor firewall
 - Add fiber link from T&E to Raptor Firewall



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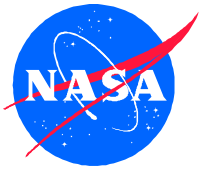
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HWCI 4.3.9

OCC Local Area Network

- Risk Assessment & Mitigation/Reliability
 - Direct connectivity to firewall controls offsite and onsite access
 - ULDB External Interface Server provides second tier security
 - Risk:
 - Implementation - Low
 - Security - Low Dependant Upon:
 - NSBF Security Plan
 - Raptor Firewall Configuration & Management
 - ULDB External Interface Server Configuration & Managment

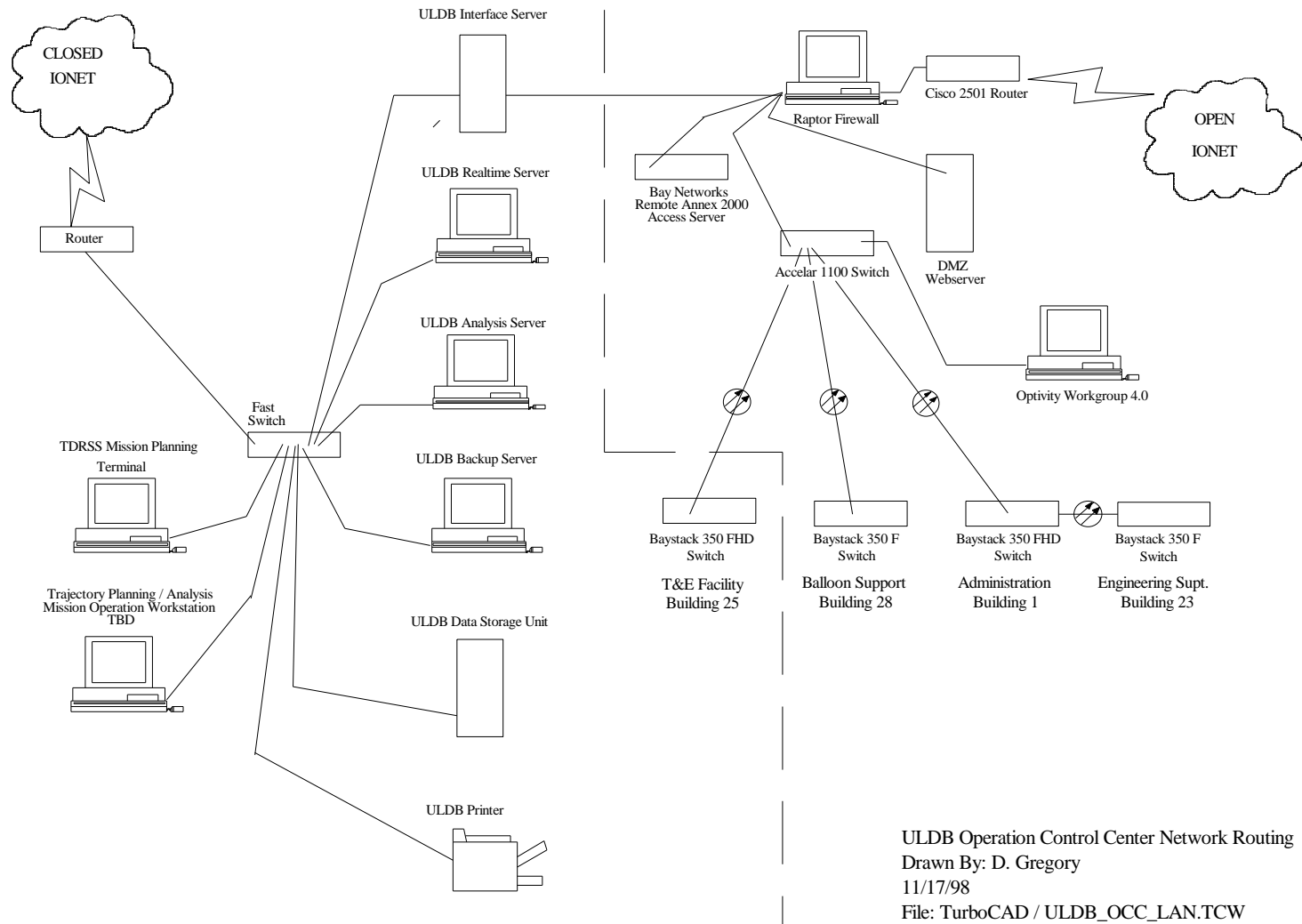


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HWC1 4.3.9 OCC Local Area Network





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HWCI 4.3.10

Mobile Seatpack (Telemetry) System

- Requirements Traceability
 - DTRD Section 4.3.2, 4.5.2
- Functional and Performance Requirements
 - 4.3.10.a: Receive ballooncraft LOS downlink TM
 - 4.3.10.b: Provide PCM bit synch and decom
 - 4.3.10.c: Provide PCM TLM display
 - 4.3.10.d: Provide LOS command transmitter
 - 4.3.10.e: Provide command console
 - 4.3.10.f: Provide global communications with the OCC
- HWCI Description
 - Support with existing LDB seatpack (install L-Band Rx)
 - Remote global communications with OCC via INMARSAT-M terminal



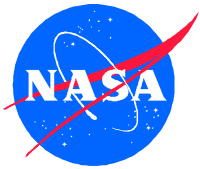
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HWCI 4.3.10 Mobile Seatpack (Telemetry) System

- Risk Assessment & Mitigation/Reliability
 - Low Risk - existing proven system



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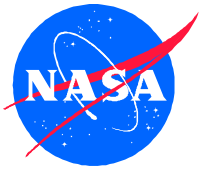
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HWCI 4.5.1

Balloon Launch Systems

- Requirements Traceability
 - DTRD Section 4.3.4.2
- Functional and Performance Requirements
 - 4.5.1.a: Provide dynamic launch vehicle
 - 4.5.1.b: Provide “inflation” spool vehicle
 - 4.5.1.c: Provide inflation hoses & diffuser
 - 4.5.1.d: Provide helium
 - 4.5.1.e: Measure helium inflation
 - 4.5.1.f: Balloon Layout equipment
 - 4.5.1.g: Ground cloths / protection
 - 4.5.1.h: Forklifts, trucks, handling equipment
 - 4.5.1.I: Verify procedures and equipment configuration
- HWCI Description
 - Utilize existing NSBF launch methods and equipment
 - Adapt commercial crane for launch vehicle
 - Other equipment NSBF shipped or leased locally



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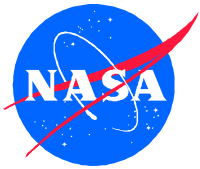
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HWCI 4.5.1

Balloon Launch Systems

- Risk Assessment & Mitigation/Reliability
 - Risk:
 - ULDB balloon not yet built or launched
 - Time to inflate unknown
 - Mitigation:
 - Current balloon design approach is taking into account the present launch techniques and equipment
 - Target inflation time is to be completed within 45 minutes (“worst case” time to inflate 29 MCF zero pressure) or insure sufficient time on launch window
 - Inflation and launch of test balloon
 - Reliability:
 - Current procedures and equipment have an established reliability



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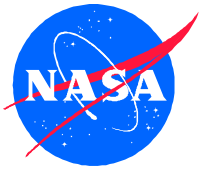
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HWCI 4.5.2

Electronic Test Equipment

- Requirements Traceability
 - DTRD Section 4.2.4, 4.3.4, 4.4.4, 4.5.4
- Functional and Performance Requirements
 - 4.5.2.a: Provide TDRSS Transponder RF Test Equipment
 - 4.5.2.b: Provide digital and analog oscilloscopes
 - 4.5.2.c: Provide RF watt meters
 - 4.5.2.d: Provide DMM / Analog Voltmeters
 - 4.5.2.e: Provide Spectrum Analyzer
 - 4.5.3.f: Provide Argos Test Set (uplink receiver)
 - 4.5.3.g: Provide LAN management / monitoring tools
- HWCI Description
 - Utilize TURFTS (TDRSS User RF Test Set)
 - Procure other equipment
 - Argos test set - Telonics Uplink Receiver
 - NSBF LAN includes LAN management workstation



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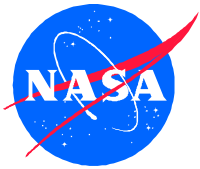
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HWC1 4.5.2

Electronic Test Equipment

- Risk Assessment & Mitigation/Reliability
 - TURFTS delivery ~ 9 months ARO
 - Options:
 - Borrow NSBF's
 - Test through SN
 - Delivery schedule will support having new unit for December '99 test flight
 - Time to procure other required equipment



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HWCI 4.5.3

Environmental Test Equipment

- Requirements Traceability
 - DTRD Section 4.2.4
- Functional and Performance Requirements
 - 4.5.3.a: Provide thermal / vacuum testing for sub-systems
 - 4.5.3.b: Provide thermal / vacuum testing for assembled ballooncraft
- HWCI Description
 - NSBF Thermal / Vacuum Chambers
 - Bemco: -70C to +70C, 3mb, ~6' X 6' X 8'
 - Webber: -60C to +80C, 3 mb, ~ 3 cu. Ft.
 - GSFC Facilities
 - Facility 238 (12' X 15') / thermal & vacuum
 - Facility 290 (27' X 40') / -90C to +75C / cryopumped
 - Wallops
 - Vacuum test chambers



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HWC1 4.5.3

Environmental Test Equipment

- Risk Assessment & Mitigation/Reliability
 - Availability of all chambers dependant upon scheduling
 - GSFC has indicated there should be no problems scheduling in 238 or 290



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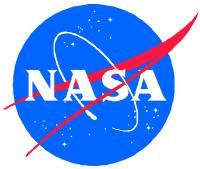
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HWCI 4.5.4

Hoists / Lifting Devices

- Requirements Traceability
 - DTRD Section 4.2.4, 4.3.4, 4.5.4
- Functional and Performance Requirements
 - 4.5.4.a: Provide hoist(s) & lifts for I&T
 - 4.5.4.b: Provide hoist(s) & lifts for Launch Site
 - 4.5.4.c: Provide hoist(s) & lifts for Recovery
- HWCI Description
 - Hoist for I&T identified in facilities requirements
 - Fork lifts available for I&T
 - Hoists and lifts provided or arranged by NSBF for Launch Site
 - Hoists and lifts provided or arranged by NSBF for recovery
 - Ballooncraft “cart” being fabricated
- Risk Assessment & Mitigation/Reliability
 - Low risk on availability or with handling



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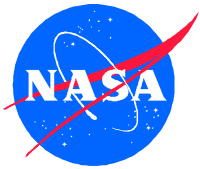
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HWC1 4.5.5

Machine Tools / Shop Equipment

- Requirements Traceability
 - DTRD Section 4.2.4, 4.3.4, 4.5.4
- Functional and Performance Requirements
 - 4.5.5.a: Provide machine shop support as required
 - 4.5.5.b: Provide electronic fabrication shop tools
 - 4.5.4.c: Provide mechanical fabrication shop tools
- HWC1 Description
 - Machine shop services available at Wallops
 - Procure electronic & mechanical fabrication tools
 - NSBF will provide tools used on recovery with exception of specialized tools required by ballooncraft
- Risk Assessment & Mitigation/Reliability
 - Low risk on availability



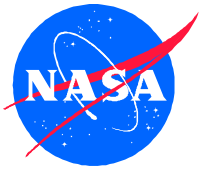
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HWCI 4.6

Personnel

- Requirements Traceability
 - DTRD Section 4.2.5, 4.3.5, 4.4.5, 4.5.5
- Functional and Performance Requirements
 - 4.6.1: Provide I&T Support
 - 4.6.2: Provide Launch - Flight Readiness Support
 - 4.6.3: Provide Flight Monitor & Control Support
 - 4.6.4: Provide Termination & Recovery Support
- HWCI Description
 - I&t supported using ULDB project team and science team
 - Preliminary - Launch support:
 - 5 ULDB Project Team (ballooncraft & balloon)
 - 1 ULDB Project Team (ground station computer)
 - 5-6 NSBF Launch Operation
 - 1 NSBF Campaign Management
 - 2 NSBF ROCC Operation
 - 1 NSBF Meteorologist



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HWC1 4.6 Personnel

- Preliminary - OCC Support (Duration of Flight)
 - 1 NSBF Flight Management (8 hrs/day)
 - 1 NSBF Meteorology (as needed)
 - 2 NSBF OCC operators (augmented w/ULDB Project)
 - Science Team (offsite)
- Termination / Recovery Support
 - 2 NSBF
 - 1 Science (Preliminary)
- Risk Assessment & Mitigation/Reliability
 - Risks:
 - New procedures / method of operation for extended flight
 - Mitigation:
 - Cross training on systems
 - Inflation & launch of comparable size ULDB balloon prior to Demo 2000